

AMENDMENTS TO THE CLAIMS

1. (Cancelled)

BI 2. (Currently Amended) ~~The multilevel metal interconnect of claim 1 and further comprising~~ A multilevel metal interconnect formed on a semiconductor substrate, the semiconductor substrate having a plurality of active areas, the multilevel metal interconnect comprising:

a plurality of layers of insulation material, the plurality of layers of insulation material including a first layer of insulation material and a top layer of insulation material, the first layer of insulation material being formed on the semiconductor substrate;

a corresponding plurality of patterned metal layers formed on the layers of insulation material so that each patterned metal layer is formed on a corresponding layer of insulation material, a patterned metal layer including a plurality of metal lines, the plurality of patterned metal layers including a first patterned metal layer and a top patterned metal layer, the first patterned metal layer being formed on the first layer of insulation material;

a plurality of contacts formed through the first layer of insulation material to make electrical connections with the active areas and the first patterned metal layer;

a plurality of vias formed through the plurality of layers of insulation material other than the first layer of insulation material, the vias making electrical connections with adjacent patterned metal layers;

a dielectric structure formed between laterally adjacent metal lines of a patterned metal layer, the dielectric structure being formed from a dielectric material, the dielectric material being different from one of the layers of insulation material; and

a plurality of trenches formed in the layers of insulation material, each trench adjoining metal lines of the top patterned metal layer, a trench extending from the

top metal layer between metal lines of the top metal layer through the top insulation layer and between metal lines of a metal layer lying below the top metal layer, each trench having a bottom surface, the trenches not including conductive material.

3. (Original) The multilevel metal interconnect of claim 2 wherein the bottom surface has a single level.

4. (Original) The multilevel metal interconnect of claim 2 wherein the bottom surface has multiple levels.

5. (Previously Amended): The multilevel metal interconnect of claim 2 wherein the bottom surface of the trench is spaced apart from a top surface of the semiconductor substrate.

6. (Previously Amended) A multilevel metal interconnect formed on a semiconductor substrate, the semiconductor substrate having a plurality of active areas, the multilevel metal interconnect comprising:

a plurality of layers of insulation material, the plurality of layers of insulation material including a first layer of insulation material and a top layer of insulation material, the first layer of insulation material being formed on the semiconductor substrate;

a corresponding plurality of patterned metal layers formed on the layers of insulation material so that each patterned metal layer is formed on a corresponding layer of insulation material, the plurality of patterned metal layers including a first patterned metal layer and a top patterned metal layer, the first patterned metal layer being formed on the first layer of insulation material;

a plurality of contacts formed through the first layer of insulation material to make electrical connections with the active areas and the first patterned metal layer;

a plurality of vias formed through the plurality of layers of insulation material other than the first layer of insulation material, the vias making electrical connections with adjacent patterned metal layers; and

a capacitive structure formed between adjacent metal lines of a patterned metal layer, the capacitive structure being formed from a dielectric material, the dielectric material being different from one of the layers of insulation material, the dielectric material including a plurality of layers of dielectric material.

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7. (Cancelled).

8. (Previously Amended) The multilevel metal interconnect of claim 2 wherein the dielectric structure is formed adjacent to a trench.

9. (Previously Amended) The multilevel metal interconnect of claim 2 wherein the dielectric structure is formed between a pair of adjacent trenches.

10. (Currently amended) A multilevel metal interconnect formed on a semiconductor substrate, the semiconductor substrate having a plurality of active areas, the multilevel metal interconnect comprising:

a plurality of layers of insulation material, the plurality of layers of insulation material including a first layer of insulation material and a top layer of insulation material, the first layer of insulation material being formed on the semiconductor substrate;

a corresponding plurality of patterned metal layers formed on the layers of insulation material so that each patterned metal layer is formed on a corresponding layer of insulation material, the plurality of patterned metal layers including a first patterned metal layer and a top patterned metal layer, the first patterned metal layer being formed on the first layer of insulation material;

a plurality of contacts formed through the first layer of insulation material to make electrical connections with the active areas and the first patterned metal layer;

a plurality of vias formed through the plurality of layers of insulation material other than the first layer of insulation material, the vias making electrical connections with adjacent patterned metal layers;

a ~~capacitive~~ dielectric structure formed between adjacent metal lines of a patterned metal layer, the ~~capacitive~~ dielectric structure ~~being formed from comprising~~ a dielectric material, the dielectric material being different from one of the layers of insulation material; and

a plurality of trenches formed in the layers of insulation material, a first trench being filled with air and a second trench being filled with the ~~capacitive structure~~ dielectric material.

Claims 11-25 (Cancelled).

26. (Currently Amended) A multilevel metal interconnect comprising:
a layer of isolation material;

a first plurality of metal lines that lie in substantially a same first horizontal plane, the first plurality of metal lines including first, second, and third metal lines formed on the layer of isolation material, the first, second, and third metal lines each having a top surface, a bottom surface, and side wall surfaces that contact the top and bottom surfaces;

a first dielectric material, the first dielectric material being formed between the first and second metal lines so that the first dielectric material contacts the side wall surface of the first metal line at a point and extends horizontally from the point to contact the side wall surface of the second metal line, lying in a first region that lies horizontally entirely between the second and third metal lines so that the first dielectric material contacts the side wall surface of the second metal line, and contacting the top surfaces of the second and third metal lines; and

a second dielectric ~~that contacts the second metal line and the third metal line~~ material formed over the first region, the second dielectric being material contacting the first dielectric material and having a dielectric constant different from a dielectric constant of the first dielectric material.

Claims 27-32 (Cancelled)

31 33. (Currently Amended) The multilevel metal interconnect of claim 30 26 and further comprising a second plurality of metal lines that lie in substantially a ~~same~~ second plane, the second plurality of metal lines including ~~third~~, fourth, and fifth metal lines that contact the ~~third~~ first dielectric material, the ~~third~~, fourth, and fifth metal lines each having a top surface, a bottom surface, and side wall surfaces.

34. (Currently Amended) The multilevel metal interconnect of claim 33 wherein the ~~first~~ second dielectric material is ~~laterally~~ formed in a second region that lies horizontally entirely between the fourth metal line and the fifth metal line.

35. (Currently Amended) The multilevel metal interconnect of claim 34 wherein the second region includes the first dielectric material such that the first dielectric material contacts the fifth metal line.

36. (Currently Amended) The multilevel metal interconnect of claim 34 wherein the second dielectric ~~contacts a side wall of the fifth metal line and a side wall of the sixth metal line~~ material is formed on and over the second region.

Claims 37-44 (Cancelled)

45. (New) A multilevel metal interconnect comprising:

a first plurality of metal lines that lie in substantially a first horizontal plane, the first plurality of metal lines having first surfaces and including first, second, and third metal lines;

a second plurality of metal lines that lie in substantially a second horizontal plane, the second plurality of metal lines having second and third surfaces, and including fourth, fifth, and sixth metal lines;

a first dielectric material that contacts the first surfaces of the first, second, and third metal lines and the second surfaces of the fourth, fifth, and sixth metal lines;

a second dielectric material formed between the first and second metal lines and the fourth and fifth metal lines, the second dielectric material extending from a point on the first horizontal plane between the first and second metal lines to a point on the second horizontal plane between the fourth and fifth metal lines, the first dielectric material and the second dielectric material having a different dielectric constant; and

a third dielectric material formed between the second and third metal lines and the fifth and sixth metal lines, the third dielectric material extending from a point on the first horizontal plane between the second and third metal lines to a point on the second horizontal plane between the fifth and sixth metal lines, the second dielectric material and the third dielectric material having a different dielectric constant.

46. (New) The multilevel metal interconnect of claim 45 and further comprising a fourth dielectric material that contacts the third surfaces of the fourth, fifth, and sixth metal lines, the fourth dielectric material having a fourth dielectric constant.

47. (New) The multilevel metal interconnect of claim 46 wherein the fourth dielectric material and the first dielectric material are equivalent.

48. (New) The multilevel metal interconnect of claim 46 and further comprising a third plurality of metal lines that lie in substantially a third horizontal plane, the third plurality of metal lines contacting the fourth dielectric material and including seventh and eighth metal lines.

49. (New) The multilevel metal interconnect of claim 48 wherein the third dielectric material extends from the point on the second horizontal plane between the fifth and sixth metal lines to a point on the third horizontal plane between the seventh and eighth metal lines.

50. (New) A multilevel metal interconnect comprising:
a first plurality of metal lines that lie in substantially a first horizontal plane, the first plurality of metal lines having first surfaces and including first, second, and third metal lines;

a second plurality of metal lines that lie in substantially a second horizontal plane, the second plurality of metal lines having second and third surfaces, and including fourth and fifth metal lines;

a third plurality of metal lines that lie in substantially a third horizontal plane, the third plurality of metal lines having fourth surfaces, and including sixth, seventh, and eighth metal lines;

a first dielectric material that contacts the first surfaces of the first, second, and third metal lines and the second surfaces of the fourth and fifth metal lines;

a second dielectric material that contacts the second surfaces of the fourth and fifth metal lines and the third surfaces of the sixth, seventh, and eighth metal lines;

a third dielectric material formed within a region that lies in the first horizontal plane between the first and second metal lines;

a fourth dielectric material formed between the second and third metal lines, and the fourth and fifth metal lines, the fourth dielectric material extending from a point on the first horizontal plane between the second and third metal lines to a point on the second horizontal plane between the fourth and fifth metal lines, the fourth dielectric material and the third dielectric material having a different dielectric constant; and

a fifth dielectric material formed within a region that lies in the third horizontal plane between the sixth and seventh metal lines, the fifth dielectric material and the fourth dielectric material having a different dielectric constant.

51. (New) The multilevel metal interconnect of claim 50 and further comprising a sixth dielectric material formed within a region that lies in the third horizontal plane between the seventh and eighth metal lines, the sixth dielectric material and the fourth dielectric material having a different dielectric constant.

52. (New) The multilevel metal interconnect of claim 50 wherein the sixth dielectric material and the fifth dielectric material are equivalent.

53. (New) The multilevel metal interconnect of claim 50 wherein the fifth dielectric material contacts a surface of the fourth metal line.

54. (New) The multilevel metal interconnect of claim 50 wherein the third dielectric material is also formed within a region that lies in the first horizontal plane between the second and third metal lines.

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AMENDMENT IN RESPONSE TO
(OFFICE ACTION DATED JANUARY 30, 2003)

PATENT

B1 55. (New) The multilevel metal interconnect of claim 50 comprising a dielectric region that contacts the fourth and fifth metal lines and lies within the second horizontal plane, the dielectric region having only the first dielectric material.
